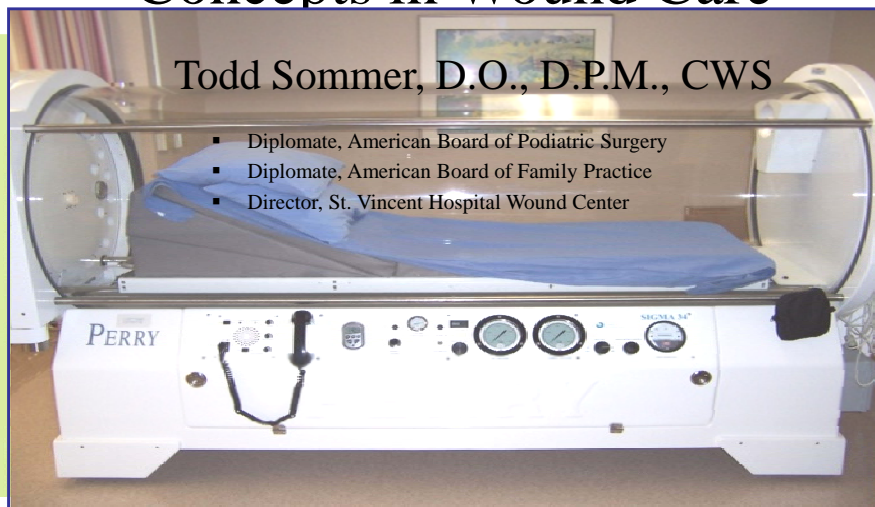


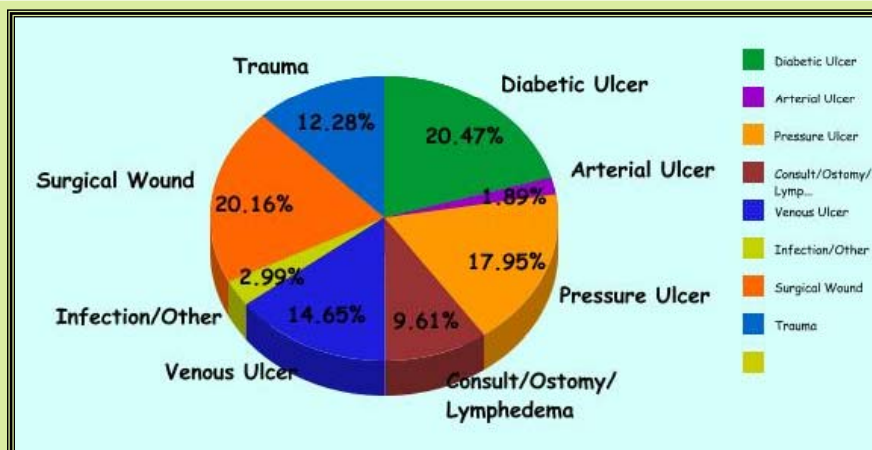
Concepts in Wound Care

Todd Sommer, D.O., D.P.M., CWS

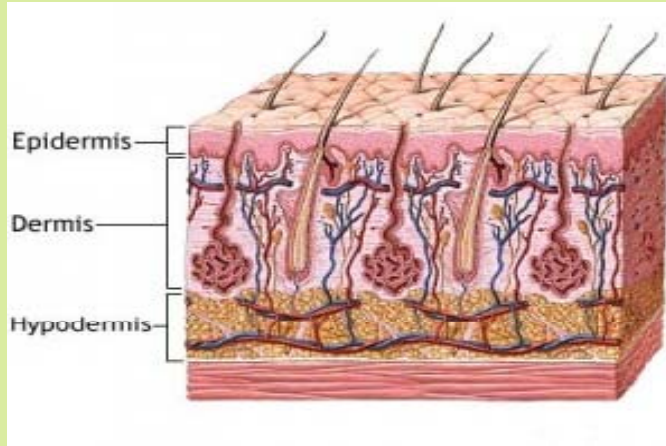
- Diplomat, American Board of Podiatric Surgery
- Diplomat, American Board of Family Practice
- Director, St. Vincent Hospital Wound Center



Types of Wounds

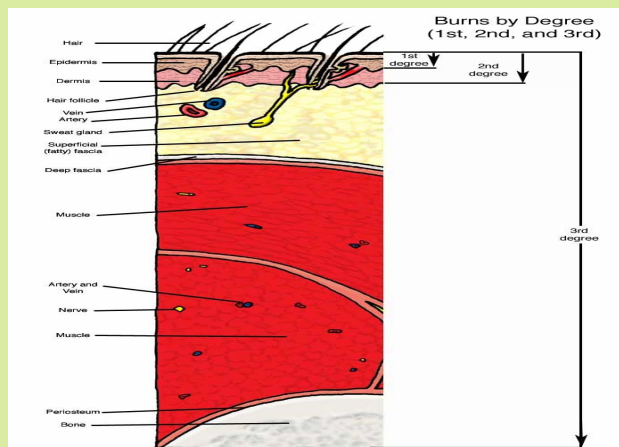


Anatomy 101



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Anatomy



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Definitions

- Epidermis is primarily Keratinocytes which anchor the epidermis to the dermis, provide strength, maintain integrity and provide barrier function.
- Dermis with Fibroblasts as the major cell type provide physical strength, collagen and an extracellular matrix.
- Hypodermis, also called the subcutaneous tissue, is the lowermost layer of the integumentary system and helps insulate the body from extreme temperature changes.

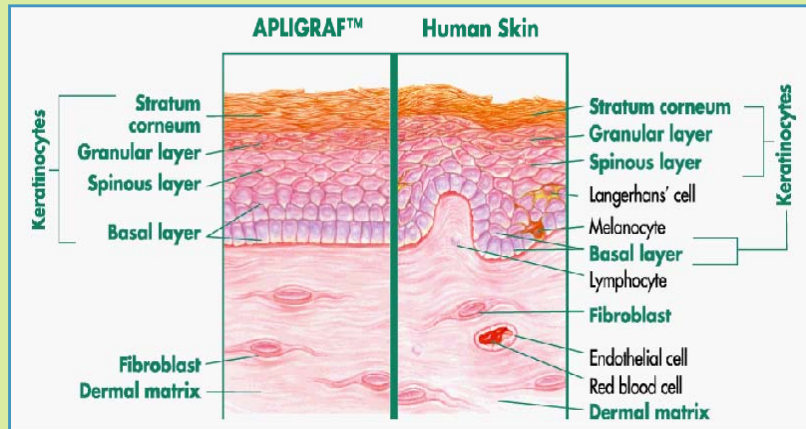


Definitions

- Fascia is the fibrous tissue network located between the skin and the underlying structure of muscle and bone.
 - Superficial layer
 - Superficial fascia is attached to the skin and is composed of connective tissue containing varying quantities of fat.
 - Deep layer
 - Deep fascia underlies the superficial layers, to which it is loosely joined by fibrous strands. It is thin but strong and densely packed, and serves to cover the muscles and to partition them into groups.



Skin Structure & Function



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CPT® Changes for Debridement

- New subheading 'Debridement'
 - No distinction between excision and debridement
 - New introductory guidelines
 - 6 revised codes, 3 new codes and 2 deleted codes
 - Section was expanded to achieve greater granularity and consistency for these services

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Debridement – Summary of Changes

- CPT® codes 11040 and 11041 have been deleted
- Parenthetical that directs user for active wound care management, see codes 97597 and 97598
- Code 11042 global period remains zero days
- Code 11043 and 11044 global days *changed* from 10-days to 0-days
- New codes 11045, 11046, and 11047 have ZZZ-global days (because there are add-on codes)



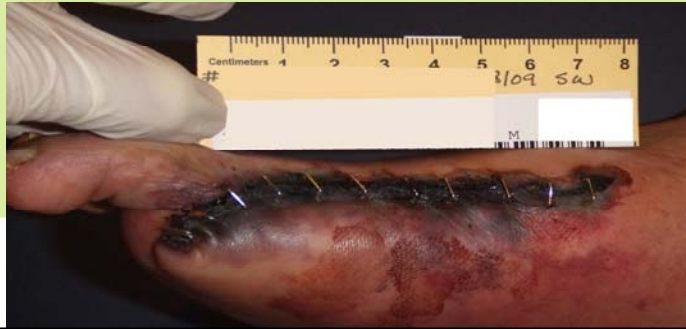
Debridement – Summary of Changes

- Guidelines
 - Code selection based on *depth* of tissue being removed and by the surface area of the wound
 - When performing debridement of a single wound, report depth using the deepest level of tissue removed
 - When performing debridement of multiple wounds, sum the surface area of those wounds that are at the same depth, but DO NOT combine sums from different depths
 - Use modifier 59 with codes 11042, 11045, 11044 to indicate that different wounds were debrided on the same day



Debridement (11042-11047)

- Removal by a physician or non-physician provider (NPP)
- Excision into the viable tissue
 - Excision of the wound edge or removal of necrotic/dead/nonviable tissue at the wound base
 - Scalpel, scissors, ultrasonic device -- tissue or a curette



Debridement Codes

- ▲ 11042: Debridement, *subcutaneous* tissue (includes epidermis and dermis, if performed); first 20 sq cm or less (RVU unchanged = 0.80)
#+ ● 11045 each add'l 20 sq cm, or part thereof (RVU = 0.33)
- ▲ 11043: Debridement, *muscle and/or fascia* (includes epidermis and dermis and subcutaneous tissue, if performed); first 20 sq cm or less (RVU = 2.00)
#+ ● 11046 each add'l 20 sq cm, or part thereof (RVU = 0.70)
- ▲ 11044: Debridement, *bone* (includes epidermis, dermis, subcutaneous tissue, muscle and/or fascia, if performed); first 20 sq cm or less (RVU = 3.60)
#+ ● 11047 each add'l 20 sq cm, or part thereof (RVU = 1.20)

Selective Debridement (97597, 97598)

- Ultrasonic debridement
 - Non-cutting -- selective debridements
 - Removal of specific, targeted areas of devitalized or necrotic tissue from a wound along the margin of viable tissue
- Cannot report active wound management code with the debridement codes for the same wound
- Zero global days
- Procedure can be performed by a physician or NPP



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Selective Debridement

- ▲ 97597: Debridement (eg, high pressure waterjet with/without suction, sharp selective debridement with scissors, scalpel and forceps), open wound, (eg, fibrin, devitalized epidermis and/or dermis, exudate, debris, biofilm), including topical application(s), wound assessment, use of a whirlpool, when performed and instruction(s) for ongoing care, per session, total wound(s) surface area; first 20 sq cm or less (RVU = 0.51)
- +▲ 97598: each add'l 20 sq cm, or part thereof (RVU = 0.24)

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Billing Selective Debridement & Procedure

- Code 29445: Application of rigid total contact leg cast and selective debridement in same visit



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Non-Selective Debridement (97602)

- Gradual removal of loosely adherent devitalized
 - Methods:
 - Wet to dry
 - Wet to moist dressings/topical ointments
- CPT® code 97602 has been assigned a status indicator "B" in the Medicare Physician Fee Schedule Database (MPFSDB), meaning that it is not separately payable under Medicare.)
- Generally, this is not a skilled service

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Non-Selective Debridement

- 97602: Removal of devitalized tissue from wound(s), non-selective debridement, without anesthesia (eg, wet-to-moist dressings, enzymatic, abrasion), including topical applications(s), wound assessment, and instruction(s) for ongoing care, per session

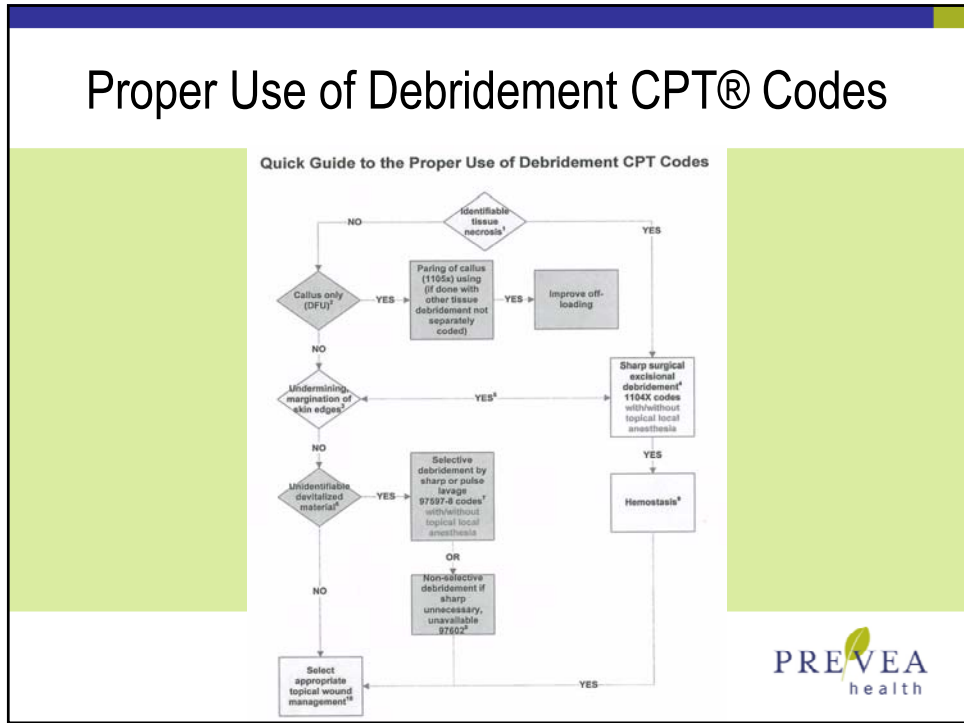


Debridement Documentation Requirements

- Physician needs to clearly document
 - Tissue removal (skin, subq, muscle, or bone)
 - Method of debridement (hydrostatic vs sharp vs abrasion)
 - Character of the wound
 - Including dimension, description of necrotic material present, description of tissue removed, degree of epithelialization, etc) before and after debridement
 - Progress of the wound's response to treatment must be made for each service



Proper Use of Debridement CPT® Codes



Bioengineered Skin Constructs

Two Categories

- Cellular-based products which actively stimulate wound healing (Apligraf, Dermagraft, Epicel)
- Acellular products which provide a substrate/covering to facilitate wound healing (Transcyte, Integra, Alloderm)



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New Medicare G Codes

- G0440: Application of tissue cultured allogeneic skin substitute or dermal substitute; for use on lower limb, includes the site preparation and debridement if performed; first 25 sq cm or less
- G0441: Application of tissue cultured allogeneic skin substitute or dermal substitute; for use on lower limb, includes the site preparation and debridement if performed; each add'l 25 sq cm



Commercial Payers

15430: Tissue cultured allogeneic skin substitute; first 25 sq cm
+ 15431: each add'l 25 sq cm, or part thereof

- 90-day global



Supply Codes

- Q4101: Apligraf, per sq cm
- Q4106: Dermagraft, per sq cm
- ***Some Medicare carriers consider Epicel investigational and thus not medically necessary or payable***



Engineering Skin Tissue Factors

- Extracellular Matrix
- Dermal Fibroblasts
- Epidermis
- A naturally occurring semipermeable membrane (Stratum Corneum)



Composite Skin Grafts

- Human skin autograft has been the gold standard
- Cultured epidermal grafts are more likely to take when the dermal bed is intact
- Attempts to replicate a full-thickness skin graft led to the development of Apligraf HSE



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Bioengineered Skin FDA-Approved Indications

- Diabetic Foot Ulcers
 - Apligraf
 - 12 week randomized trial of 208 patients
 - Complete wound closure in 56% of patients compared to 38% of the control group. Also significant reduction in osteomyelitis and amputation.
 - Dermagraft
 - 12 week randomized study with an incidence of closure of 30% and 18% for the active and control arms.

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Bioengineered Skin FDA-Approved Indications

- Venous Leg Ulcers
 - Apligraf is the only approved tissue engineered product.
 - In a pivotal multicenter randomized study of 293 patients, it was more effective than compression alone in patients who healed by 6 months (63% vs 49%).



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Mechanism of Action

- Delivery of living cells is associated with the release of growth factors and cytokines.
- Epidermal and dermal components work in concert to these mediators that would not be detected with the epidermal and dermal component alone.

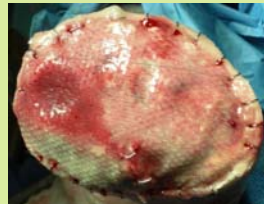
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The way things were...



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...the way things are now.



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Conditions Accepted for HBOT at St. Vincent Hospital

- Wound care
 - Chronic diabetic wounds
 - Treatment of compromised skin grafts or flaps
 - Acute peripheral arterial insufficiency
 - Acute traumatic peripheral ischemia
 - Crush injuries
 - reattachment of severed limbs
- Delayed radiation injury
 - Osteoradionecrosis
 - Soft tissue radionecrosis
- Infections
 - Chronic refractory osteomyelitis
 - Progressive necrotizing infections



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11 yr old male - Crush Injury



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11 yr old male - Crush Injury



Photo 1-25-08
MVA 1-3-08
Start HBOT BID
1-25-08

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11 yr old male - Crush Injury



Photo 1-30-08
HBOT tx #6

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11 yr old male- Crush Injury



Photo 2-6-08
HBOT tx #13



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11 yr old male- Crush Injury



Photo 2-13-08
HBOT tx # 20

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11 yr old male- Crush Injury



Photo 3-12-08
1st Apligraf App
HBOT tx # 41

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11 yr old male- Crush Injury



HBOT #45 completed 3-18-08



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11 yr old male- Crush Injury



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Transcutaneous Oxygen Monitoring (TCOM or TcPO₂)



- Direct measure of O₂ delivery
- Evaluation of Hyperbaric Benefit

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Extremity Arterial Studies

- ▲ 93922: Limited bilateral noninvasive physiologic studies of upper or lower extremity arteries, (eg, for lower extremity: ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus bidirectional, Doppler waveform recording and analysis at 1-2 levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus volume plethysmography at 1-2 levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries with transcutaneous oxygen tension measurements at 1-2 levels)

New guidelines regarding physiologic studies in CPT® 2011



Extremity Arterial Studies

- ▲ 93923: Complete bilateral noninvasive physiologic studies of upper or lower extremity arteries, 3 or more levels (eg, for lower extremity: ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus segmental blood pressure measurements with bidirectional Doppler waveform recording and analysis, at 3 or more levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus segmental volume plethysmography at 3 or more levels, or ankle/brachial indices at distal posterior tibial and anterior tibial/dorsalis pedis arteries plus segmental transcutaneous oxygen tension measurements at 3 or more level(s), or single level study with provocative functional maneuvers (eg, measurements with postural provocative tests, or measurement with reactive hyperemia)



SPP & PVR Testing

- Skin Perfusion Pressure
 - Measures capillary pressures
 - Laser guided light
 - Unaffected by minor edema
- Pulse Volume Recording
 - Arterial waveforms unaffected by calcification



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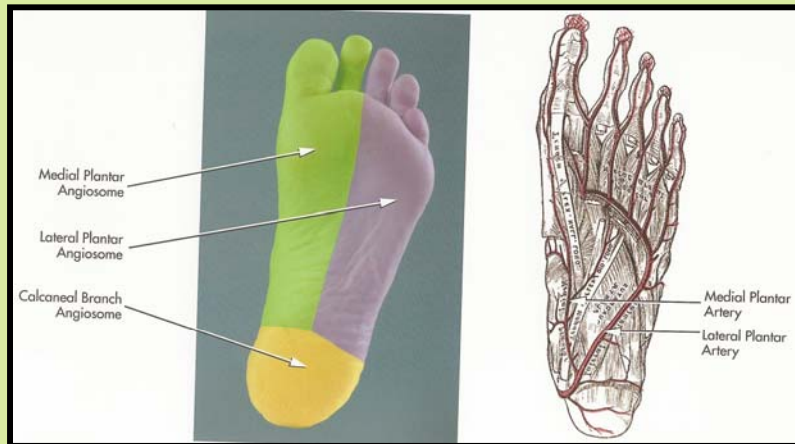
Angiosomes

The **Anterior Tibial Angiosome** is fed by the anterior tibial artery and the dorsalis pedis branch of the anterior tibial artery. It includes the anterior ankle and entire dorsum foot.



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Angiosomes



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80yr Male - Diabetic Ulcer status post resection - Compromised Graft



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DM Lower Extremity Problems

- Diabetic Foot Infections and Ulcers
- Diabetic Neuropathy
- Lower Extremity - PVD
- Charcot Foot



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Diabetic Foot Ulcers

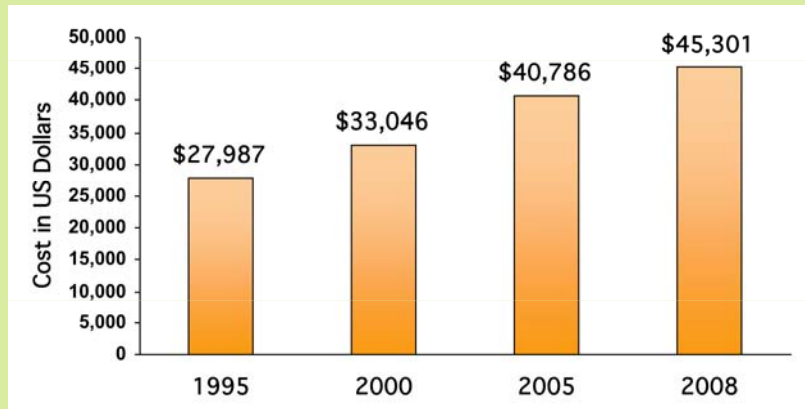
- One of the most common complications of diabetes
- Annual incidence 1% to 4%¹⁻²
- Lifetime risk 15% to 25%³⁻⁴
- ~15% of diabetic foot ulcers result in lower extremity amputation^{3,5}
- ~85% of lower limb amputations in patients with diabetes are preceded by ulceration⁶⁻⁷
- Peripheral neuropathy is a major contributing factor in diabetic foot ulcers¹⁻⁷
 - Other factors: foot deformity, callus, trauma, and peripheral vascular disease

1. Reiber and Ledoux. In The Evidence Base for Diabetes Care. Williams et al. eds. Hoboken, NJ: John Wiley & Sons; 2002:641-665.
2. Boulton et al. NEJM. 2004;351:48.
3. Sanders. J Am Podiatry Med Assoc. 1994;84:322.

4. Boulton et al. Lancet. 2005;366:1719.
5. Ramsey et al. Diabetes Care 1999;22:382.
6. Pecoraro et al. Diabetes Care. 1990;13:513.
7. Apelqvist and Larsson. Diabetes Metab Res Rev. 2000;16:S75.

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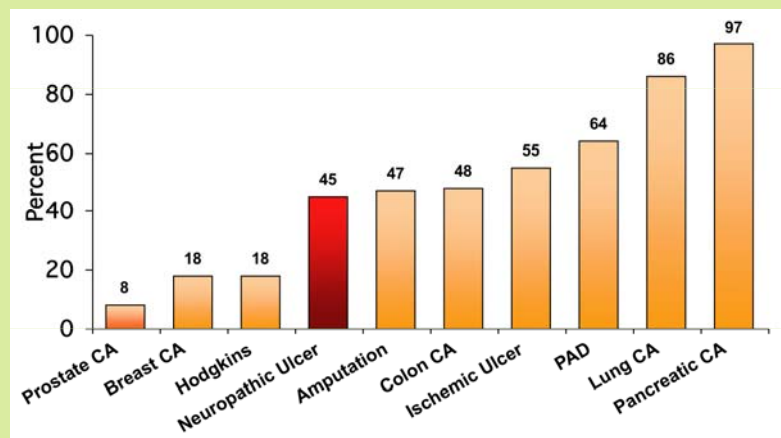
Costs to Treat a Diabetic Foot Ulcer Over a 2-Year Period Following Detection



Ramsey et al. Diabetes Care. 1999;22:382.
Cost analyses based on percent change in the medical component of the US consumer price index.



5-Year Mortality Rates



Armstrong et al. Int Wound J. 2007;Dec;4(4):286.

CA = Carcinoma.
PAD = Peripheral artery disease.



Consensus Development Conference on Diabetic Foot Wound Care

- American Diabetes Association Consensus Development Conference on Diabetic Foot Wound Care convened in April 1999
- Regarding the treatment of diabetic foot wounds, the panel agreed:
“Any wound that remains unhealed after 4 weeks is cause for concern, as it is associated with worse outcomes, including amputations.”



Consensus Development Conference on Diabetic Foot Wound Care: 7-8 April 1999, Boston, Massachusetts. American Diabetes Association. Diabetes Care. 1999;22:1354.
Note: This consensus statement also was reviewed and endorsed by the American Podiatric Association.



Successful Healing of Diabetic Foot Ulcers

- Data from a large, prospective, multicenter trial of diabetic patients with foot ulcerations were subsequently analyzed
- Ability of the 4-week healing rate to predict complete healing within a 12-week period was assessed
- Study results, which included 203 patients, showed that:
“Patients in whom ulcer size fails to reduce by half over the first 4 weeks of treatment are unlikely to achieve wound healing over a reasonable period.”

Sheehan et al. Diabetes Care. 2003;26:1879.



Wound Healing Society: 2006 Guidelines for Treatment of Diabetic Ulcers



Steed et al. Wound Reg Rep. 2006;14:680.

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Optimal Treatment Strategy

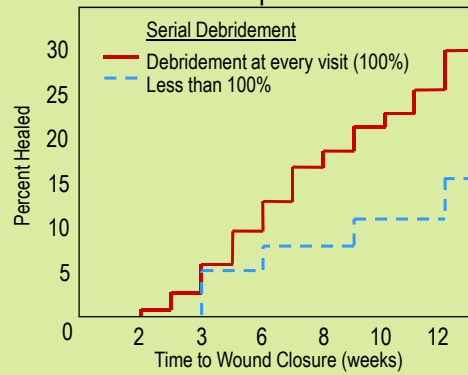
- In their review of the optimal treatment strategy for diabetic foot ulcers, Armstrong and colleagues (2007) concluded:
“Arguably, the use of an active therapy such as a bio-engineered skin substitute to stimulate healing in non-responding wounds after 4 weeks’ treatment is the optimal care in 2007.”
- Among the various advanced healing modalities, bioengineered skin substitutes (eg, Dermagraft®) are perhaps the best studied and supported with the most rigorous clinical data

Armstrong et al. US Endocrine Review. 2007;(Spring):60.

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Debride

Higher Healing Rates with More Frequent Debridement



DFU Time to Healing

Kaplan-Meier Method

N=118

Cardinal, Eisenbud, Armstrong, et al. Wound Rep Reg. 2009;17:In Press.



Dermagraft®



- Trace the edge of the wound onto the bag
- Cut Dermagraft to size
- Separate the Dermagraft backing



Dermagraft®

Dermagraft® / Apligraf® Comparison

	Dermagraft	Apligraf
Composition	Single dermal layer 250 µ permeable	Bi-layered 750 µ non-permeable
Supplied / Shelf Life	Cryopreserved at peak / 6 Months	Made to order / lasts up to 10 Days
USP Sterility Testing	Before shipment	After patient application
Potency ^a	8000 fibroblasts per mm ³ ; 80 µg/mm ³ hyaluronan; 18.75 µg/mm ³ collagen	500 fibroblasts per mm ³ ; 7.45 µg/mm ³ hyaluronan; 2 µg/mm ³ collagen
Fibroblast/ Collagen platform ^b	Scaffold, cryo-stress response, human collagen	Bovine collagen
Ease of Application	Place in wound	Suture & fenestrate

Dermagraft Directions for Use; 2007.
Apligraf Prescribing Information; April 2006.
^aWaugh & Sherratt. Wound Rep Reg. 2007;15:556.
^bRoberts & Mansbridge. Can J Plast Surg. 2002;10:6A.



Diabetic Neuropathy (250.6_, 357.2)

- Loss of sensory or feeling in foot and leg
- 60% - 70% of diabetics have mild to severe CNS damage
- 30% diabetics (>40yo) have impaired sensation on feet
- May cause sharp pains and burning in feet
- Motor involvement: muscle weakness with production of hammertoes, bunions, and metatarsal disorders leading to ulcers
- Tx: Neurontin, Lyrica, Anodyne tx.

Source: Centers for Disease Control and Prevention, 2005



Diabetic Wounds & Ulcers

- Wagner classification
 - Grade 0- Skin intact
 - Grade 1-Superficial diabetic ulcer
 - Grade 2-Extension → ligament, tendon, capsule or deep fascia without abscess or osteo
 - Grade 3-Deep ulcer with abscess or osteo
 - Grade 4-Gangrene forefoot
 - Grade 5-Extensive gangrene

Charcot Foot (250.6_, 713.5)



Charcot Neuroarthropathy/Charcot Foot

- Progressive deterioration of wt. bearing joints
- Stages
 - 0 Clinical stage - Erythema, swelling, localized heat, and normal radiographs
 - 1 Fragmentation stage (acute) - periarticular fx., subluxation/dislocation → deformity
 - 2 Coalescence stage → reabsorption bone debris
 - 3 Repairative/consolidation stage (chronic charcot) - restabilization of foot



Wound Dressing

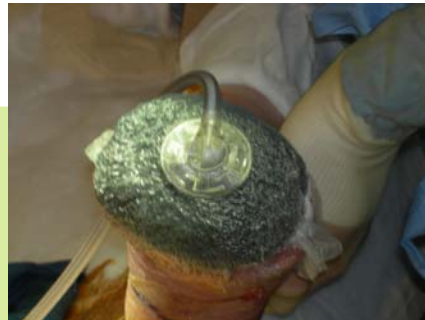


Negative Pressure Therapy (Vacuum Assisted Closure)



- Stage 3 & 4 Pressure Ulcers
- Dehisced Incisions
- Compromised Flaps & Grafts
- Acute Traumatic Wounds
- Chronic Wounds or Ulcers with Exposed Tendons or Hardware
- Over New Skin Grafts & Flaps
- Chronic Ulcers (venous, arterial, diabetic)

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Hyperbaric Oxygen Therapy

Hyperbaric oxygen therapy (HBOT) involves administration of 100% oxygen at pressures greater than 1 atmosphere absolute (ATA)



Hyperbaric Oxygen Therapy



10-15% Wound Pts
utilize HBOT



Conditions Accepted for HBOT at St. Vincent Hospital

- Wound care
 - Chronic diabetic wounds
 - Treatment of compromised skin grafts or flaps
 - Acute peripheral arterial insufficiency
 - Acute traumatic peripheral ischemia
 - Crush injuries
 - reattachment of severed limbs
- Delayed radiation injury
 - Osteoradionecrosis
 - Soft tissue radionecrosis
- Infections
 - Chronic refractory osteomyelitis
 - Progressive necrotizing infections



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69y diabetic male – Caucasian
Acute traumatic ischemia secondary to New Shoe Gear



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Choosing the Ideal Dressing

- Protect from 2nd infection
- Provide a moist wound healing environment
- Protect granulation tissue and absorb exudate



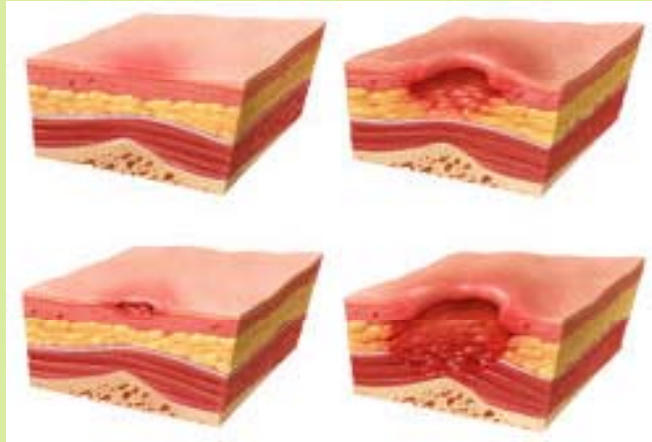
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Pressure Ulcers

- Stage I: Nonblanchable erythema of intact skin, heralding lesion of skin ulcer (Dx 707.21)
- Stage II: Partial-thickness skin loss (Dx 707.22)
- Stage III: Full thickness skin loss > to fascia (Dx 707.23)
- Stage IV: Full thickness skin loss with damage to muscle, bone or supporting structures (Dx 707.24)
- Post heel eschar (ulcer)-Tx (Dx 707.25: Pressure ulcer, unstageable. Tip: Assign only if ulcer is covered by eschar, has been treated with skin or other graft, or is documented as deep tissue injury but not documented as due to trauma)

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Pressure Ulcer Stages



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Dx Coding for Ulcers

- Pressure Ulcers
 - Code First the site of the pressure ulcer (707.00-707.09)
 - Followed by the ulcer stage (707.20-707.9)

- Ulcers, except pressure ulcer
 - Code, if applicable, any causal condition *first*
 - Code range 707.10-707.19

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Resources

- CPT® 2011
- LCD for Wound Care (L28572) for Wisconsin Physicians Services Insurance Corporation: Revised 1-1-2011
- LCD for Application of Bioengineered Skin Substitutes (L30135) for Wisconsin Physicians Services Insurance Corporation: Revised 1-1-2011



The End

